Actaris Regulator "K" Values

and Their Application

The regulator flow coefficient (K) is in simple terms a constant per square inch of orifice opening to adjust the basic orifice flow formula to arrive at the capacity figure in accordance with test results. The "K" value takes into account not only the designated installed orifice but all the other orifices in the valve body and throat area of the regulator. It is used to calculate maximum, wide open flow rates for sizing relief valves.

Installed orifices, smaller than 1/4 inch, when installed in any valve body will produce approximately the same flow rate and will have "K" values about the same.

The same orifice, 1/4 inch and larger, installed in different size valve bodies and on different model regulators will produce different flow rates and will have different "K" factors due to valve body and throat orifices and outlet piping.

Before calculating capacities, it must be determined if the flow is below or above critical velocity. If the inlet pressure absolute is approximately twice (1.89 times greater) or more than the outlet pressure absolute, then the flow is above critical velocity or the velocity of sound.

EXAMPLES:

1. Atmospheric Pressure = 14.2 PSIA
   Inlet Pressure (P) = 50.0 PSIG
   Outlet Pressure (p) = 1.0 PSIG

   P (absolute) = 14.2 + 50 = 64.2 =4.22
   P (absolute) = 14.2 + 1 = 15.2

   The flow rate will be above critical velocity.

2. Atmospheric Pressure = 13.6 PSIA
   Inlet Pressure (P) = 10.0 PSIG
   Outlet Pressure (p) = 7 inches w.c. = .25 PSIG

   P (absolute) = 13.6 + 10 = 23.6 =1.7
   P (absolute) = 13.6 + .25 = 13.85

   The flow rate will be below critical velocity.

BELOW Critical Velocity Q = $K\sqrt{pa \times \Delta P}$
ABOVE Critical Velocity Q = 1/2 K x PA

Where:
- Q = Standard Cubic Feet Per Hour (SCFH) of .6 specific gravity gas
- K = Regulator Flow Coefficient
- PA = Inlet Pressure Absolute (PSIA)
- pa = Outlet Pressure Absolute (PSIA)
- Δ P = Differential of Inlet and Outlet Pressure (PSIG)

EXAMPLES:

1. B34R
   5/8 x fl orifice
   25 PSIG inlet pressure and 7 inches w.c. outlet pressure

If the regulator fails open, what is the maximum volume of gas the regulator will flow if an external relief valve is sized and adjusted to maintain 1 PSIG downstream pressure. Assume 14.7 PSIA atmospheric pressure.

Test for critical velocity: $\frac{14.7 + 25.0}{14.7 + .25 =} = \frac{39.7}{14.95} = 2.66$

Since the answer is above 1.89, the flow is above critical velocity. Therefore:

$Q = 1/2K \times PA \quad 1/2(750) \times (25 + 14.7) = 14{,}900$ SCFH

Since the B34 will vent 3325 SCFH with 1 PSIG outlet pressure, (see table "Internal Relief Capacity" on page 3 of B34 catalog) the external relief valve must be sized to relieve 14,900 – 3325 or 11,375 SCFH with 1 PSIG in the downstream piping.

2. CL342
   7/8 orifice
   30 PSIG inlet pressure and 15 PSIG outlet pressure

If the regulator fails open, what is the maximum volume of gas the regulator will flow if an external relief valve is sized and adjusted to hold 18 PSIG in the downstream piping. Assume 14.4 PSIA atmospheric pressure.

Test for critical velocity: $\frac{14.4 + 30 =}{14.4 + 18 =} \quad \frac{44.4}{32.4} = 1.37$

Since the answer is below 1.89, the flow is below critical velocity. Therefore:

$Q = 1200\sqrt{(18.0 + 14.4) \times (12)} = 1200\sqrt{(32.4) \times (12)} = 1200\sqrt{388.8}$
$= 23{,}700$ SCFH

Wide open "K" factors will very depending on the regulator used. Many "K" factors for specific regulators are given on the catalog sheets. The "K" factors in the following table are for B34 and CL34 regulators. For orifice sizes under 1/4" the value applies to all Actaris regulators. The data was derived from tests in the Engineering Lab. For "K" values for other than B34 and CL34 regulators with larger than 1/4" orifices, see the Actaris catalog for the specific regulator in question.

Wide Open "K" and "Cg" Factors Per Orifice Size for B34 and CL34 Regulators and all Actaris Regulators with Orifice Sizes Under 1/4"

Orifice Size	Wide Open "K" Factor	Wide Open "Cg" Factor
1/16	8.9	3.4
3/32	17.5	6.8
1/8	30.0	11.6
3/16	71.0	27.5
1/4	127.0	49.0
5/16	193.0	75.0
3/8	290.0	112.0
1/2	500.0	193.0
5/8	700.0	271.0
3/4	900.0	348.0
7/8	1200.0	465.0
1/4 x 3/8	125.0	48.0
3/8 x 1/2	305.0	118.0
5/8 x 3/4	750.0	290.0
3/4 x 7/8	950.0	368.0
7/8 x 1	1245.0	482.0

Cg. = .3875K

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